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TITLE: NON-POLLUTED SINTERED COMPACT OF ASBESTOS AND NON-POLLUTION TREATMENT

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INVENTOR-INFORMATION:
NAME
MORIYOSHI, YUSUKE
URANO, TERUO
MIYAJI, HIROSHI

ASSIGNEE-INFORMATION:
NAME COUNTRY
MURAKASHI SEKKAI KOGYO KK N/A

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ABSTRACT:

PROBLEM TO BE SOLVED: To make it possible to obtain a sintered compact consisting of non- polluted asbestos by using asbestos, the treatment of which as industrial waste is of a problem and incineration ashes an raw materials and recycle the asbestos as adsorbents or architectural materials, such as tiles, bricks and cement fillers.

SOLUTION: This sintered compact is the reactive sintered

compact of a
mixture composed of asbestos-containing materials and
incineration ashes of
municipal refuse. The sintered compact is obtd. by heating
the mixture
composed of the asbestos-containing materials and the
incineration ashes of the
municipal waste in a temp. range from 600 to 1700°C,
thereby effecting and
sintering the mixture. Reaction and sintering progress
simultaneously at a
relatively low temp. with the components of the
incineration ashes of the
municipal refuse and chrysotile
(3MgO.2SiO<SB>2</SB>.2H<SB>2</SB>O) which is
the essential component of the asbestos. The harmful
chrysotile is annihilated
and the asbestos is changed to a solid soln. contg.
harmless gehlenite
(2CaO.Al<SB>2</SB>O<SB>3</SB>.SiO<SB>2</SB>) and/or
akermanite
(2CaO.MgO.SiO<SB>2</SB>), foresterite (2MgO.SiO<SB>2</SB>)
and crystobalite
(SiO<SB>2</SB>) by this reaction.

PATENT ABSTRACTS OF JAPAN

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(71)Applicant : MURAKASHI SEKKAI KOGYO KK

(72)Inventor : MORIYOSHI YUSUKE
URANO TERUO
MIYAJI HIROSHI

(54) NON-POLLUTED SINTERED COMPACT OF ASBESTOS AND NON-POLLUTION TREATMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To make it possible to obtain a sintered compact consisting of non- polluted asbestos by using asbestos, the treatment of which as industrial waste is of a problem and incineration ashes an raw materials and recycle the asbestos as adsorbents or architectural materials, such as tiles, bricks and cement fillers.

SOLUTION: This sintered compact is the reactive sintered compact of a mixture composed of asbestos-containing materials and incineration ashes of municipal refuse. The sintered compact is obtd. by heating the mixture composed of the asbestos-containing materials and the incineration ashes of the municipal waste in a temp. range from 600 to 1700°C, thereby effecting and sintering the mixture. Reaction and sintering progress simultaneously at a relatively low temp. with the components of the incineration ashes of the municipal refuse and chrysotile (3MgO.2SiO2.2H2O) which is the essential component of the asbestos. The harmful chrysotile is annihilated and the asbestos is changed to a solid soln. contg. harmless gehlenite (2CaO.Al2O3.SiO2) and/or akermanite (2CaO.MgO.SiO2), foresterite (2MgO.SiO2) and crystobalite (SiO2) by this reaction.

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CLAIMS

[Claim(s)]
[Claim 1] The harmless-ized sintering object of the asbestos characterized by being the reaction sintering object of an asbestos inclusion and the mixture of a city dust incinerated ash.
[Claim 2] The harmless-ized art of the asbestos characterized by heating and carrying out reaction sintering of an asbestos inclusion and the mixture of a city dust incinerated ash to a 600 to 1700 degrees C temperature requirement.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] It considers as the sintered compact which turned and asbestos enables it to reuse this invention as building materials, such as an adsorbent, and a tile, brick, cementation material, harmless by using as a raw material the asbestos and the incinerated ash from which the processing poses a problem as industrial waste.
[0002]
[Description of the Prior Art] The discharge of the city dust in our country reaches [per year] in a little more than 50 million t, and is in the inclination which increases increasingly. The cure is a social problem and the radical solution is searched for. In the present condition, after incineration processing is carried out and 70% of these city dust performs solidification by cement or medicine processing, acid treatment, etc. as an incinerated ash, reclamation abandonment is carried out. Furthermore, recently, an incinerated ash is a particle and the research for cutting down abandonment cost etc. is tried by carrying out plasma fusion and attaining reduction-ization by ******'s, very much. Moreover, the increase also of the yield of a sewage sludge is being enhanced and the disposal poses a problem as the saturation level of the sewerage increases. Although the landfill of many of sewage sludges is finally carried out, long-term reservation of the landfill ground of sludge is becoming difficult, and it is incinerating and carrying out the landfill of the sludge in the larger cities for mitigation of capacity and a weight.
[0003] On the other hand, asbestos is the fibrous mineral produced naturally, it is strong to an acid or alkali and excels in thermal resistance, insulation, and the mechanical strength, and it has been widely used as industrial material and a building material for many years in order to also tend to carry out processing. Especially an asbestos cement sheet and an asbestos cement plate have little expansion and contraction by dryness or moisture, and it has been used in large quantities as lightweight nonflammable building materials excellent in endurance, noise insulation nature, adiathermancy, and water resistance. However, development of the harmless-ized processing technique of the asbestos in the construction scrap wood which carcinogenic [of asbestine lung cancer] comes to be pointed out and discharged in large quantities especially as waste is urgent in recent years.
[0004]
[Problem(s) to be Solved by the Invention] If it carries out from a viewpoint of resources practical use, both city dust glow incinerated ash and asbestos will aim [this invention] at the thing which uses both mixture as a reaction-sintering object, turn harmless and can reuse asbestos as building materials, such as an adsorbent, and a tile, brick, cementation material, paying attention to being a precious material and to do for being.
[0005]
[Means for Solving the Problem] The harmless-ized sintering object of the asbestos in connection with this invention is a reaction sintering object of an asbestos inclusion and the mixture of a city dust incinerated ash. Moreover, an asbestine harmless-ized art heats and carries out reaction sintering of an asbestos inclusion and the mixture of a city dust incinerated ash to a 600 to 1700 degrees C temperature

requirement.
[0006] Asbestine principal components are Si and Mg. On the other hand, the principal components of a city dust incinerated ash are calcium, Si, aluminum, Mg, Na, and K, and the component which generates the liquid phase (glass phase) easily like calcium, Si, Na, and K exists in these. Since this invention is quickly diffused through the liquid phase which is made to heat and carry out reaction sintering of both mixture at a furnace, and the reaction generated, it is the feature which a reaction and sintering progress simultaneously at low temperature comparatively (it is only called sintering reaction mixture phase sintering and the following). While asbestine harmless-ization is made by changing asbestos to the solid solution containing a GERE night (2 CaO-aluminum 2O3, SiO2) and/or an AKERUMA night (2 CaO-MgO-SiO2), a forsterite (2 MgO-SiO2), a cristobalite (SiO2), etc. by this sintering, it becomes possible to use the obtained sintered compact for a building material etc.
[0007] Asbestos is divided into serpentine system asbestos and amphibole system asbestos. Many of asbestos currently used is serpentine system asbestos, and it consists of a chrysotile (3MgOand2SiO2.2H2O) as a main mineral. Amphibole system asbestos consists of an amosite or crocidolite, and there is little amount of here [used]. All are fibrous minerals, carcinogenic [the] comes to be pointed out and use regulation changes severely.
[0008] On the other hand, an incinerated ash is the waste produced by incineration processing of city dust, and after it performs solidification by cement or medicine processing, acid treatment, etc., reclamation abandonment of it is carried out. The principal component of an incinerated ash is a mineral constituent of calcium, Si, aluminum, Mg, Na, K, and P, and has accomplished vitrified or the silic acid salt compound which the part crystallized, including Si most mostly.
[0009]
[Embodiments of the Invention] this invention mixes these both and they are made it to heat and do reaction sintering at a furnace, and as for Si which is the principal component of a city dust incinerated ash, and the chrysotile which is an asbestine principal component, a reaction and sintering progress simultaneously at low temperature comparatively, and a detrimental chrysotile disappears and it changes with these reactions to the solid solution containing a harmless GERE night and/or a harmless AKERUMA night, a forsterite, and a cristobalite.
[0010] When using this reaction sintering object as a building material and high-performance material, according to a use, sintering temperature and sintering time are changed or after treatment is performed.
[0011] The requirements in the case of using a sintering object as high-performance material, such as adsorption, require that a sintering object should have big bulk density. The sintering temperature at that time is 600 degrees C to 1300 degrees C in the sample of the various mixed rates of an incinerated ash and asbestos. if acid treatment of the sintering object sintered under these conditions is carried out and alkalinity is extracted -- sintering -- the adsorption function which was excellent since the porosity of an atom and molecule order generated inside of the body is demonstrated since there is no contraction at sintering especially in the temperature of 1100 degrees C or less -- sintering -- much pore exists in the inside of the body Therefore, although it can use as an adsorbent even if he has no acid treatment, it is still more effective if acid treatment is carried out.
[0012] The requirements in the case of using a sintering object as a building material are the intensity of a sintering object. The relation of sintering ashes, an asbestine mixed rate, and sintering temperature for that is as follows if the case of sintering time 2 hours is taken for an example.
[0013] (1) When the mixed rate of sintering ashes is 5% or less 1250 to 1700 degrees C temperature requirement (2) The mixed rate of sintering ashes 5 to 20% of case 1200 to 1350 degrees C temperature requirement (3) For the mixed rate of sintering ashes, 20 to 50% of case is a 1150 to 1300 degrees C temperature requirement (4). When the mixed rate of sintering ashes is 50% or more, it becomes a 1100 to 1280 degrees C temperature requirement.
[0014] However, these relations are based on 2 sintering hours. If sintering time becomes longer, sintering temperature will shift to a low temperature side a little.
[0015] Conversely, as long as it makes sintering temperature high, sintering time may be shorter than 2 hours. For example, from 1350 to 1700 degrees C, the chemical reaction of the asbestos can be carried

out to another matter also in several minutes to 30 minutes, and the sintering object which has sufficient intensity can be manufactured. Hereafter, an example explains this invention.

[0016]

[Example 1] 50g of incinerated ashes of a chemical composition and chrysotile asbestos 50g shown in Table 1 were put in and mixed with the 500ml beaker, 200ml of distilled water was added further, and it mixed for 1 hour using the magnetic agitator. After evaporating moisture for 5 hours and making it dry in the dryer which set this mixture as 110 degrees C, trituration mixture of the dry matter was carried out for 10 minutes in the mortar. It is this sample 250 kg/cm2 It cast, it put into the crucible of an alumina and reaction sintering was carried out in 900-degree-C air for 2 hours. The asbestine peak was not observed at all by the X-ray diffraction figure of the obtained sample, but the peak of the matter which can belong mainly at a GERE night was checked.

[0017]

[Table 1]

成分名	SiO_2	Al_2O_3	CaO	MgO	Na_2O	K_2O
含有量	38.2	20.1	7.1	3.8	2.0	1.1

[0018]

[Example 2] By the same blending ratio of coal as an example 1, reaction sintering was carried out in 1100-degree-C air for 2 hours. Like the example 1, the asbestine peak was not observed at all but the peak of the matter which can belong mainly at a GERE night was checked by the X-ray diffraction figure of the obtained sample.

[0019]

[Example 3] By the same blending ratio of coal as an example 1, reaction sintering was carried out in 1150-degree-C air for 2 hours. Like the example 1, the asbestine peak was not observed at all but the peak of the matter which can belong mainly at a GERE night was checked by the X-ray diffraction figure of the obtained sample.

[0020] Drawing 1 shows the X-ray diffraction figure of the sintered compact of asbestos and examples 1-3 used as a raw material. As shown in drawing, a clear difference is between the peak positions of an asbestine X-ray diffraction view and the peak positions of the sample of each example which were used as a raw material, and it is shown that the same crystal is generating within this sintering temperature requirement. As a result of examining the X-ray diffraction figure of the sintered compact of examples 1-3 in detail, it is a GERE night (2 CaO-aluminum 2O3, SiO2). It is almost in agreement with a peak position. In the peak position of examples 1-3, it is an AKERUMA night (2 CaO-MgO-SiO2). The peak which can be identified also exists. However, this is the crystal structure (tetragonal phase) with same GERE night and AKERUMA night, and it is presumed to be a natural result that the solid solution generates a GERE night and an AKERUMA night since the conditions which an AKERUMA night generates since making the solid solution and a lot of MgO(s) exist are ready.

[0021] Moreover, the contraction by sintering did not have the sample of examples 1 and 2, and it was porosity. If it becomes an example 3, much pores which carried out various forms exist in a dense sintering-like organization. If sintering temperature becomes 1150 degrees C or more, pore will become almost spherical and vitrification by the reaction of an incinerated ash and asbestos will progress considerably. If a sintered compact is observed for a high scale factor, many corniform particles of the rectangular parallelepiped which has one-side an about 1-micron cross section exist in the vitrified field. A corniform particle becomes still larger and a form becomes clear as sintering temperature becomes high. Moreover, the result of EPMA analysis of a corniform particle is shown in drawing 2 . calcium, Si, aluminum, and Mg are detected so that clearly from drawing 2 . This supports the result of the X-ray diffraction of the above-mentioned [these corniform particles], and it is shown that it is a GERE night. And since Mg of the principal component of not only the principal component of a GERE night but an AKERUMA night was detected in the corniform particle, a particle proves that a GERE night and an

AKERUMA night are the solid solutions.
[0022]
[Table 2]

成分名	SiO_2	Al_2O_3	CaO	MgO	Na_2O	K_2O
含有量	54.5	16.5	6.0	2.7	2.0	1.9

[0023]
[Example 4] 30g of sewage-sludge incinerated ashes of a chemical composition and chrysotile asbestos 70g shown in Table 2 were put in and mixed with the 500ml beaker, 200ml of distilled water was added further, and it mixed for 1 hour using the magnetic agitator. After evaporating moisture for 5 hours and making it dry in the dryer which set this mixture as 110 degrees C, trituration mixture of the dry matter was carried out for 10 minutes in the mortar. It is this sample 250 kg/cm2 It cast, it put into the crucible of an alumina and reaction sintering was carried out in 800-degree-C air for 20 hours. The asbestine peak was not observed at all by the X-ray diffraction figure of the obtained sample, but the peak of the matter which can belong mainly at a GERE night was checked.
[0024]
[Example 5] 5g of sewage-sludge incinerated ashes of a chemical composition and chrysotile asbestos 95g shown in Table 2 were put in and mixed with the 500ml beaker, 200ml of distilled water was added further, and it mixed for 1 hour using the magnetic agitator. After evaporating moisture for 5 hours and making it dry in the dryer which set this mixture as 110 degrees C, trituration mixture of the dry matter was carried out for 10 minutes in the mortar. It is this sample 250 kg/cm2 It cast, it put into the crucible of an alumina and reaction sintering was carried out in 1350-degree-C air for 2 hours. The asbestine peak was not observed at all by the X-ray diffraction figure of the obtained sample, but the peak of the matter which can belong mainly to a forsterite and a cristobalite was checked.
[0025]
[Effect of the Invention] The sintered compact with which asbestos turned harmless by using as a raw material the asbestos and the incinerated ash from which the processing poses a problem as industrial waste is obtained, and it can reuse as building materials, such as an adsorbent, and a tile, brick, cementation material.

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TECHNICAL FIELD

[The technical field to which invention belongs] It considers as the sintered compact which turned and asbestos enables it to reuse this invention as building materials, such as an adsorbent, and a tile, brick, a cement filler, harmless by using as a raw material the asbestos and the incinerated ash from which the processing poses a problem as industrial waste.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] If it carries out from a viewpoint of resources practical use, both city dust glow incinerated ash and asbestos will aim [this invention] at the thing which uses both mixture as a reaction-sintering object, turn harmless and can reuse asbestos as building materials, such as an adsorbent, and a tile, brick, a cement filler, paying attention to being a precious material and to do for being.
[0005]

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MEANS

[Means for Solving the Problem] The harmless-ized sintering object of the asbestos in connection with this invention is a reaction sintering object of an asbestos inclusion and the mixture of a city dust incinerated ash. Moreover, an asbestine harmless-ized art heats and carries out reaction sintering of an asbestos inclusion and the mixture of a city dust incinerated ash to a 600 to 1700 degrees C temperature requirement.
[0006] Asbestine principal components are Si and Mg. On the other hand, the principal components of a city dust incinerated ash are calcium, Si, aluminum, Mg, Na, and K, and the component which generates the liquid phase (glass phase) easily like calcium, Si, Na, and K exists in these. Since this invention is quickly diffused through the liquid phase which is made to heat and carry out reaction sintering of both mixture at a furnace, and the reaction generated, it is the feature which a reaction and sintering progress simultaneously at low temperature comparatively (it is only called sintering reaction mixture phase sintering and the following). While asbestine harmless-ization is made by changing asbestos to the solid solution containing a GERE night (2 CaO-aluminum 2O3, SiO2) and/or an AKERUMA night (2 CaO-MgO-SiO2), a forsterite (2 MgO-SiO2), a cristobalite (SiO2), etc. by this sintering, it becomes possible to use the obtained sintered compact for a building material etc.
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[0008] On the other hand, an incinerated ash is the waste produced by incineration processing of city dust, and after it performs solidification by cement or medicine processing, acid treatment, etc., reclamation abandonment of it is carried out. The principal component of an incinerated ash is a mineral constituent of calcium, Si, aluminum, Mg, Na, K, and P, and has accomplished vitrified or the silic acid salt compound which the part crystallized, including Si most mostly.
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[Embodiments of the Invention] this invention mixes these both and they are made it to heat and do reaction sintering at a furnace, and as for Si which is the principal component of a city dust incinerated ash, and the chrysotile which is an asbestine principal component, a reaction and sintering progress simultaneously at low temperature comparatively, and a detrimental chrysotile disappears and it changes with these reactions to the solid solution containing a harmless GERE night and/or a harmless AKERUMA night, a forsterite, and a cristobalite.
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alkalinity is extracted -- sintering -- the adsorption function which was excellent since the porosity of an atom and molecule order generated inside of the body is demonstrated since there is no contraction at sintering especially in the temperature of 1100 degrees C or less -- sintering -- much pore exists in the inside of the body Therefore, although it can use as an adsorbent even if he has no acid treatment, it is still more effective if acid treatment is carried out.

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[0013] (1) When the mixed rate of sintering ashes is 5% or less 1250 to 1700 degrees C temperature requirement (2) The mixed rate of sintering ashes 5 to 20% of case 1200 to 1350 degrees C temperature requirement (3) For the mixed rate of sintering ashes, 20 to 50% of case is a 1150 to 1300 degrees C temperature requirement (4). When the mixed rate of sintering ashes is 50% or more, it becomes a 1100 to 1280 degrees C temperature requirement.

[0014] However, these relations are based on 2 sintering hours. If sintering time becomes longer, sintering temperature will shift to a low temperature side a little.

[0015] Conversely, as long as it makes sintering temperature high, sintering time may be shorter than 2 hours. For example, from 1350 to 1700 degrees C, the chemical reaction of the asbestos can be carried out to another matter also in several minutes to 30 minutes, and the sintering object which has sufficient intensity can be manufactured. Hereafter, an example explains this invention.

[0016]

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[0017]

[Table 1]

成分名	SiO_2	Al_2O_3	CaO	MgO	Na_2O	K_2O
含有量	38.2	20.1	7.1	3.8	2.0	1.1

[0018]

[Example 2] By the same blending ratio of coal as an example 1, reaction sintering was carried out in 1100-degree-C air for 2 hours. Like the example 1, the asbestine peak was not observed at all but the peak of the matter which can belong mainly at a GERE night was checked by the X-ray diffraction figure of the obtained sample.

[0019]

[Example 3] By the same blending ratio of coal as an example 1, reaction sintering was carried out in 1150-degree-C air for 2 hours. Like the example 1, the asbestine peak was not observed at all but the peak of the matter which can belong mainly at a GERE night was checked by the X-ray diffraction figure of the obtained sample.

[0020] Drawing 1 shows the X-ray diffraction figure of the sintered compact of asbestos and examples 1-3 used as a raw material. As shown in drawing, a clear difference is between the peak positions of an asbestine X-ray diffraction view and the peak positions of the sample of each example which were used as a raw material, and it is shown that the same crystal is generating within this sintering temperature requirement. As a result of examining the X-ray diffraction figure of the sintered compact of examples 1-3 in detail, it is a GERE night (2 CaO-aluminum 2O3, SiO2). It is almost in agreement with a peak

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[0021] Moreover, the contraction by sintering did not have the sample of examples 1 and 2, and it was porosity. If it becomes an example 3, much pores which carried out various forms exist in a dense sintering-like organization. If sintering temperature becomes 1150 degrees C or more, pore will become almost spherical and vitrification by the reaction of an incinerated ash and asbestos will progress considerably. If a sintered compact is observed for a high scale factor, many corniform particles of the rectangular parallelepiped which has one-side an about 1-micron cross section exist in the vitrified field. A corniform particle becomes still larger and a form becomes clear as sintering temperature becomes high. Moreover, the result of EPMA analysis of a corniform particle is shown in drawing 2 . calcium, Si, aluminum, and Mg are detected so that clearly from drawing 2 . This supports the result of the X-ray diffraction of the above-mentioned [these corniform particles], and it is shown that it is a GERE night. And since Mg of the principal component of not only the principal component of a GERE night but an AKERUMA night was detected in the corniform particle, a particle proves that a GERE night and an AKERUMA night are the solid solutions.

[0022]

[Table 2]

成分名	SiO_2	Al_2O_3	CaO	MgO	Na_2O	K_2O
含有量	54.5	16.5	6.0	2.7	2.0	1.9

[0023]

[Example 4] 30g of sewage-sludge incinerated ashes of a chemical composition and chrysotile asbestos 70g shown in Table 2 were put in and mixed with the 500ml beaker, 200ml of distilled water was added further, and it mixed for 1 hour using the magnetic agitator. After evaporating moisture for 5 hours and making it dry in the dryer which set this mixture as 110 degrees C, trituration mixture of the dry matter was carried out for 10 minutes in the mortar. It is this sample 250 kg/cm2 It cast, it put into the crucible of an alumina and reaction sintering was carried out in 800-degree-C air for 20 hours. The asbestine peak was not observed at all by the X-ray diffraction figure of the obtained sample, but the peak of the matter which can belong mainly at a GERE night was checked.

[0024]

[Example 5] 5g of sewage-sludge incinerated ashes of a chemical composition and chrysotile asbestos 95g shown in Table 2 were put in and mixed with the 500ml beaker, 200ml of distilled water was added further, and it mixed for 1 hour using the magnetic agitator. After evaporating moisture for 5 hours and making it dry in the dryer which set this mixture as 110 degrees C, trituration mixture of the dry matter was carried out for 10 minutes in the mortar. It is this sample 250 kg/cm2 It cast, it put into the crucible of an alumina and reaction sintering was carried out in 1350-degree-C air for 2 hours. The asbestine peak was not observed at all by the X-ray diffraction figure of the obtained sample, but the peak of the matter which can belong mainly to a forsterite and a cristobalite was checked.

[Translation done.]

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(43)公開日　平成９年(1997)８月12日

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(71)出願人　000203047
村樫石灰工業株式会社
栃木県安蘇郡葛生町宮下町１番10号

(72)発明者　守吉　佑介
東京都世田谷区砧８－２－27

(72)発明者　浦野　輝男
栃木県佐野市石塚775－３

(72)発明者　宮路　寛
栃木県宇都宮市西川田町925－４

(74)代理人　弁理士　青麻　昌二

(54)【発明の名称】　アスベストの無害化焼結体及び無害化処理方法

(57)【要約】

【目的】　産業廃棄物としてその処理が問題となっているアスベストと焼却灰を原料としてアスベストが無害化された焼結体が得られ、吸着剤とか、タイル、レンガ、セメント充填材等の建築材料として再利用できるようにする。

【構成】　アスベスト含有物と都市ゴミ焼却灰の混合物の反応焼結体である。アスベスト含有物と都市ゴミ焼却灰の混合物を６００℃から１７００℃の温度範囲に加熱し反応焼結させることにより得られる。都市ゴミ焼却灰の成分とアスベストの主成分であるクリソタイル（$3MgO \cdot 2SiO_2 \cdot 2H_2O$）は、比較的低温で反応と焼結が同時に進み、この反応によって、有害なクリソタイルは消滅し、無害なゲーレナイト（$2CaO \cdot Al_2O_3 \cdot SiO_2$）及び／又はアケルマナイト（$2CaO \cdot MgO \cdot SiO_2$）、フォルステライト（$2MgO \cdot SiO_2$）、クリストバライト（$SiO_2$）を含む固溶体に変化する。

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【特許請求の範囲】

【請求項１】　アスベスト含有物と都市ゴミ焼却灰の混合物の反応焼結体であることを特徴とするアスベストの無害化焼結体。

【請求項２】　アスベスト含有物と都市ゴミ焼却灰の混合物を６００℃から１７００℃の温度範囲に加熱し、反応焼結させることを特徴とするアスベストの無害化処理方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、産業廃棄物としてその処理が問題となっているアスベストと焼却灰を原料としてアスベストが無害化された焼結体とし、吸着剤とか、タイル、レンガ、セメント充填材等の建築材料として再利用できるようにするものである。

【０００２】

【従来の技術】我国における都市ゴミの排出量は年間５０００万トン余りに達し、ますます増加する傾向にある。その対策は社会問題であり、抜本的な解決策が求められている。現状では、これらの都市ゴミの７０％が焼却処理され、焼却灰としてセメントによる固化、もしくは薬剤処理、酸処理などを行った後、埋め立て投棄されている。更に最近では、焼却灰が微粒子であり大変嵩ばるので、プラズマ溶融して減容化を図ることによって投棄コストを削減するための研究などが試みられている。また下水道の普及率が高まるに従って下水汚泥の発生量も増加の一途をたどっており、その処分が問題となっている。下水汚泥の多くは最終的に埋立処分されているが、大都市では汚泥の埋立処分地の長期確保が困難になってきており、容積及び重量の軽減のために汚泥を焼却して埋立処分している。

【０００３】他方、アスベストは天然に産する繊維状の鉱物で、酸やアルカリに強く、耐熱性や絶縁性、機械的強度に優れており、加工もし易いため、古くから工業材料、建築材料として広く使用されてきた。特に石綿スレート、石綿セメント板は、乾燥や湿気による伸縮が少なく、耐久性、遮音性、断熱性、耐水性に優れている軽量な不燃建材として大量に使用されてきた。しかしながら、近年、アスベストの肺ガンの発ガン性が指摘されるに至り、特に廃棄物として大量に排出される建築廃材中のアスベストの無害化処理手法の開発が焦眉の急となっている。

【０００４】

【発明が解決しようとする課題】本発明は、資源活用の観点からすれば都市ゴミ焼焼却灰とアスベストの両者とも貴重な素材であることに着目し、両者の混合物を反応焼結体とし、アスベストを無害化し、吸着剤とか、タイル、レンガ、セメント充填材等の建築材料として再利用できるいようにすることを目的とする。

【０００５】

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【課題を解決するための手段】本発明にかかわるアスベストの無害化焼結体は、アスベスト含有物と都市ゴミ焼却灰の混合物の反応焼結体である。またアスベストの無害化処理方法は、アスベスト含有物と都市ゴミ焼却灰の混合物を６００℃から１７００℃の温度範囲に加熱し、反応焼結させる。

【０００６】アスベストの主成分はＳｉとＭｇである。他方、都市ゴミ焼却灰の主成分はＣａ、Ｓｉ、Ａｌ、Ｍｇ、Ｎａ、Ｋであり、これらの中にはＣａ、Ｓｉ、Ｎａ、Ｋなどのように容易に液相（ガラス相）を生成する成分が存在する。本発明は、両者の混合物を炉で加熱し反応焼結させるものであり、反応が生成した液相を通して速く拡散するため、比較的低温で反応と焼結が同時に進む（反応液相焼結、以下単に焼結という）ことが特徴である。この焼結によりアスベストをゲーレナイト（$2CaO\cdot Al_2O_3\cdot SiO_2$）及び／又はアケルマナイト（$2CaO\cdot MgO\cdot SiO_2$）、フォルステライト（$2MgO\cdot SiO_2$）、クリストバライト（$SiO_2$）等を含む固溶体に変化させることによってアスベストの無害化がなされると共に、得られた焼結体を建築材料などに利用することが可能となる。

【０００７】アスベストは蛇紋岩系石綿と角閃石系石綿に分けられる。使用されているアスベストの多くは蛇紋岩系石綿であり、主要鉱物としてクリソタイル（$3MgO\cdot 2SiO_2\cdot 2H_2O$）からなっている。角閃石系石綿はアモサイト又はクロシドライトより成っているものであり、こちらの使用量は少ない。いずれも繊維状の鉱物であり、その発ガン性が指摘されるに至り使用規制が厳しく成ってきている。

【０００８】一方、焼却灰は都市ゴミの焼却処理により産出される廃棄物で、セメントによる固化、又は薬剤処理、酸処理などを行った後、埋め立て投棄されている。焼却灰の主成分はＣａ、Ｓｉ、Ａｌ、Ｍｇ、Ｎａ、Ｋ、Ｐの無機成分で、Ｓｉを最も多く含み、ガラス状もしくは一部が結晶化した硅酸塩化合物を成している。

【０００９】

【発明の実施の形態】本発明は、この両者を混合し、炉で加熱し、反応焼結させるものであり、都市ゴミ焼却灰の主成分であるＳｉとアスベストの主成分であるクリソタイルは、比較的低温で反応と焼結が同時に進み、この反応によって、有害なクリソタイルは消滅し、無害なゲーレナイト及び／又はアケルマナイト、フォルステライト、クリストバライトを含む固溶体に変化する。

【００１０】この反応焼結物を建築材料、機能性材料として利用する場合は、用途に応じて焼結温度、焼結時間を変化させたり、後処理を行ったりする。

【００１１】吸着などの機能性材料として焼結体を利用する場合の要件は、焼結体が大きな嵩密度をもつことが必要である。その時の焼結温度は、焼却灰とアスベストの種々の混合割合の試料において、６００℃から１３００℃である。この条件下で焼結した焼結体を酸処理して

アルカリ分を抽出すると、焼結体中に原子、分子オーダーの多孔が生成するので優れた吸着機能を発揮する。特に１１００℃以下の温度における焼結では、全く収縮がないので、焼結体中に沢山の気孔が存在する。そのため、酸処理なしでも吸着剤として利用できるが、酸処理をすればさらに効果的である。

【００１２】焼結体を建築材料として利用する場合の要件は焼結体の強度である。そのための焼結灰とアスベストの混合割合と焼結温度の関係は、焼結時間２時間の場合を例にとれば、以下のようになる。

【００１３】(1) 焼結灰の混合割合が５％以下の場合は、１２５０℃から１７００℃の温度範囲

(2) 焼結灰の混合割合が５％から２０％の場合は、１２００℃から１３５０℃の温度範囲

(3) 焼結灰の混合割合が２０から５０％の場合は、１１５０℃から１３００℃の温度範囲

(4) 焼結灰の混合割合が５０％以上の場合は、１１００℃から１２８０℃の温度範囲となる。

【００１４】しかしながら、これらの関係は、２時間の焼結時間を基準にしている。焼結時間がもっと長くなれば、焼結温度はやや低温側へずれる。

＊【００１５】逆に焼結温度を高くすれば、焼結時間は２時間より短くて良い。例えば、１３５０℃から１７００℃の間では、数分から３０分の間でもアスベストを別の物質に化学反応させることができ、十分な強度を有する焼結体を製造することができる。以下、実施例により、本発明を説明する。

【００１６】

【実施例１】表１に示す化学成分の焼却灰５０ｇとクリソタイルアスベスト５０ｇを５００ｍｌのビーカーに入れて混ぜ、更に蒸留水２００ｍｌを加え、磁性撹拌機を用いて１時間混合した。この混合物を１１０℃に設定した乾燥機中で５時間水分を蒸発させて乾燥させた後、乾燥物を乳鉢中で１０分間粉砕混合した。この試料を２５０ｋｇ／ｃｍ^2 で成型し、アルミナのるつぼに入れて９００℃空気中で２時間反応焼結させた。得られた試料のＸ線回析図形にはアスベストのピークは全く観察されず、主としてゲーレナイトに帰属できる物質のピークが確認された。

【００１７】

【表１】

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成分名	SiO_2	Al_2O_3	CaO	MgO	Na_2O	K_2O
含有量	38.2	20.1	7.1	3.8	2.0	1.1

【００１８】

【実施例２】実施例１と同じ配合割合で、１１００℃空気中で２時間反応焼結させた。得られた試料のＸ線回析図形は、実施例１と同様アスベストのピークは全く観察されず、主としてゲーレナイトに帰属できる物質のピークが確認された。

【００１９】

【実施例３】実施例１と同じ配合割合で、１１５０℃空気中で２時間反応焼結させた。得られた試料のＸ線回析図形は、実施例１と同様アスベストのピークは全く観察されず、主としてゲーレナイトに帰属できる物質のピークが確認された。

【００２０】図１は、原料として使用したアスベストと実施例１～３の焼結体のＸ線回析図形を示したものである。図から分かるように、原料として使用したアスベストのＸ線回析図のピーク位置と各実施例の試料のピーク位置との間には明らかな違いがあり、この焼結温度範囲内で同一の結晶が生成していることを示している。実施例１～３の焼結体のＸ線回析図形を詳細に検討した結果、ゲーレナイト（$2CaO \cdot Al_2O_3 \cdot SiO_2$）のピーク位置と殆ど一致する。実施例１～３のピーク位置にはアケルマナイト（$2CaO \cdot MgO \cdot SiO_2$）に同定しうるピークも存在する。しかし、これはゲーレナイトとアケルマナイトが同じ結※

※晶構造（正方晶）であり、ゲーレナイトとアケルマナイトは固溶体を作ること、多量のＭｇＯが存在するのでアケルマナイトが生成する条件が整っているので固溶体が生成するのは、当然の結果と推定される。

【００２１】また、実施例１、２の試料は焼結による収縮は全くなく多孔質であった。実施例３になると半融状の密な組織の中に種々の形をした気孔が多数存在する。焼結温度が１１５０℃以上になると、気孔はほとんど球状になり、焼却灰とアスベストの反応によるガラス化がかなり進む。焼結体を高倍率で観察すると、ガラス化した領域の中に１辺１ミクロンほどの断面を有する直方体の角状粒子が多数存在する。焼結温度が高くなるにつれて、角状粒子はますます大きくなり、形が明瞭になる。また角状粒子のＥＰＭＡ分析の結果を図２に示す。図２から明らかなように、Ｃａ、Ｓｉ，Ａｌ、Ｍｇが検出される。このことはこれらの角状粒子が前述のＸ線回析の結果を裏付けるものであり、ゲーレナイトであることを示すものである。そして角状粒子中にゲーレナイトの主成分だけでなく、アケルマナイトの主成分のＭｇが検出されたことから、粒子がゲーレナイトとアケルマナイトは固溶体であることを裏付けるものである。

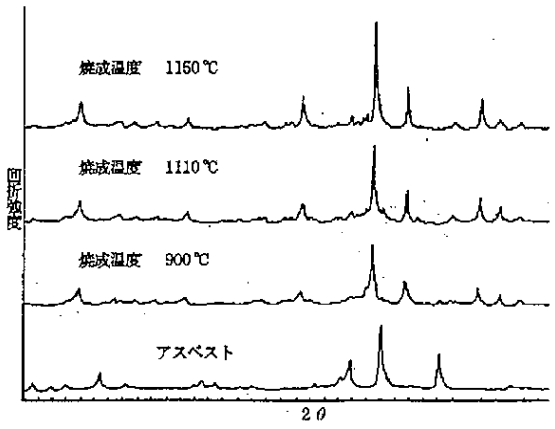
【００２２】

【表２】

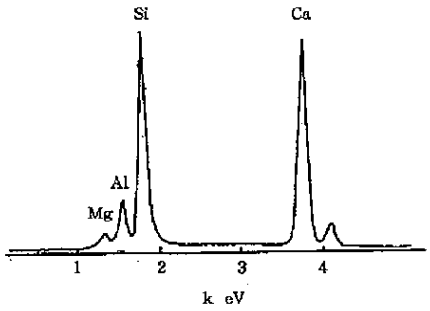
成分名	SiO_2	Al_2O_3	CaO	MgO	Na_2O	K_2O
含有量	54.5	16.5	6.0	2.7	2.0	1.9

【００２３】
【実施例４】表２に示す化学成分の下水汚泥焼却灰３０ｇとクリソタイルアスベスト７０ｇを５００ｍｌのビーカーに入れて混ぜ、さらに蒸留水２００ｍｌを加え、磁性撹拌機を用いて１時間混合した。この混合物を１１０℃に設定した乾燥機中で５時間水分を蒸発させて乾燥させた後、乾燥物を乳鉢中で１０分間粉砕混合した。この試料を２５０ｋｇ／ｃｍ^2 で成型し、アルミナのるつぼに入れて８００℃空気中で２０時間反応焼結させた。得られた試料のＸ線回析図形にはアスベストのピークは全く観察されず、主としてゲーレナイトに帰属できる物質のピークが確認された。
【００２４】
【実施例５】表２に示す化学成分の下水汚泥焼却灰５ｇとクリソタイルアスベスト９５ｇを５００ｍｌのビーカーに入れて混ぜ、さらに蒸留水２００ｍｌを加え、磁性撹拌機を用いて１時間混合した。この混合物を１１０℃＊に設定した乾燥機中で５時間水分を蒸発させて乾燥させた後、乾燥物を乳鉢中で１０分間粉砕混合した。この試料を２５０ｋｇ／ｃｍ^2 で成型し、アルミナのるつぼに入れて１３５０℃空気中で２時間反応焼結させた。得られた試料のＸ線回析図形にはアスベストのピークは全く観察されず、主としてフォルステライト、クリストバライトに帰属できる物質のピークが確認された。
【００２５】
【発明の効果】産業廃棄物としてその処理が問題となっているアスベストと焼却灰を原料としてアスベストが無害化された焼結体が得られ、吸着剤とか、タイル、レンガ、セメント充填材等の建築材料として再利用できる。
【図面の簡単な説明】
【図１】原料アスベストと、実施例１～３の焼結体のＸ線回析図形である。
【図２】焼結体中の角状粒子のＥＰＭＡ分析の結果である。

【図１】



【図２】



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【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】０００４
【補正方法】変更
【補正内容】
【０００４】
【発明が解決しようとする課題】本発明は、資源活用の観点からすれば都市ゴミ焼却灰とアスベストの両者とも貴重な素材であることに着目し、両者の混合物を反応焼結体とし、アスベストを無害化し、吸着剤とか、タイル、レンガ、セメント充填材等の建築材料として再利用できるようにすることを目的とする。

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